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(54) **ATTACHMENT MECHANISMS FOR
COUPLING FIREARMS TO SUPPORTING
STRUCTURES**

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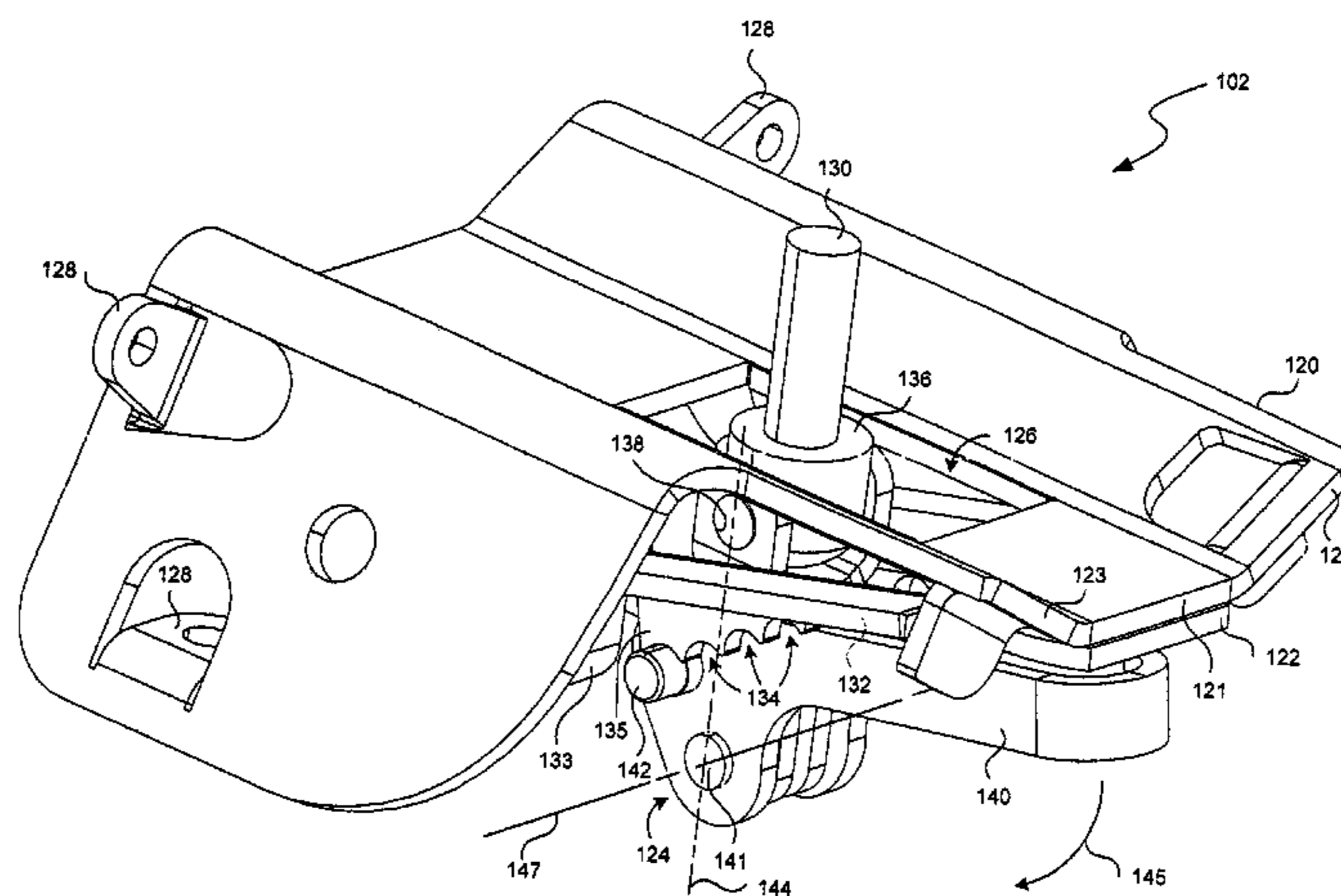
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(57) **ABSTRACT**

Attachment mechanisms for attaching firearms to support structures are disclosed herein. In one embodiment, an attachment mechanism for attaching a firearm to a support structure includes an interface member coupled to a latching subassembly. The latching subassembly includes having an attachment portion and a latching arm. The attachment portion is configured to engage a connector fastened to the firearm through the aperture, and the latching arm lockably retains the attachment portion proximate to the interface member.

18 Claims, 7 Drawing Sheets



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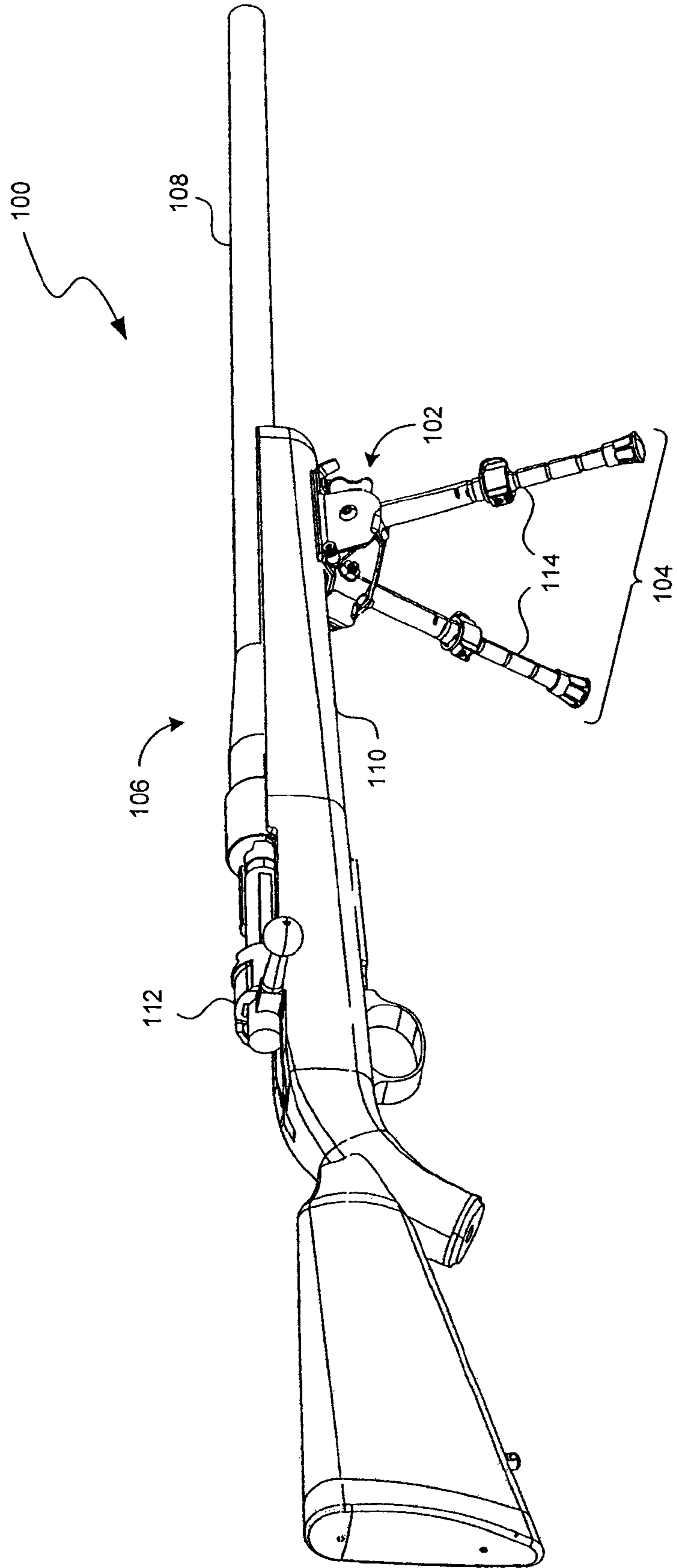


FIG. 1

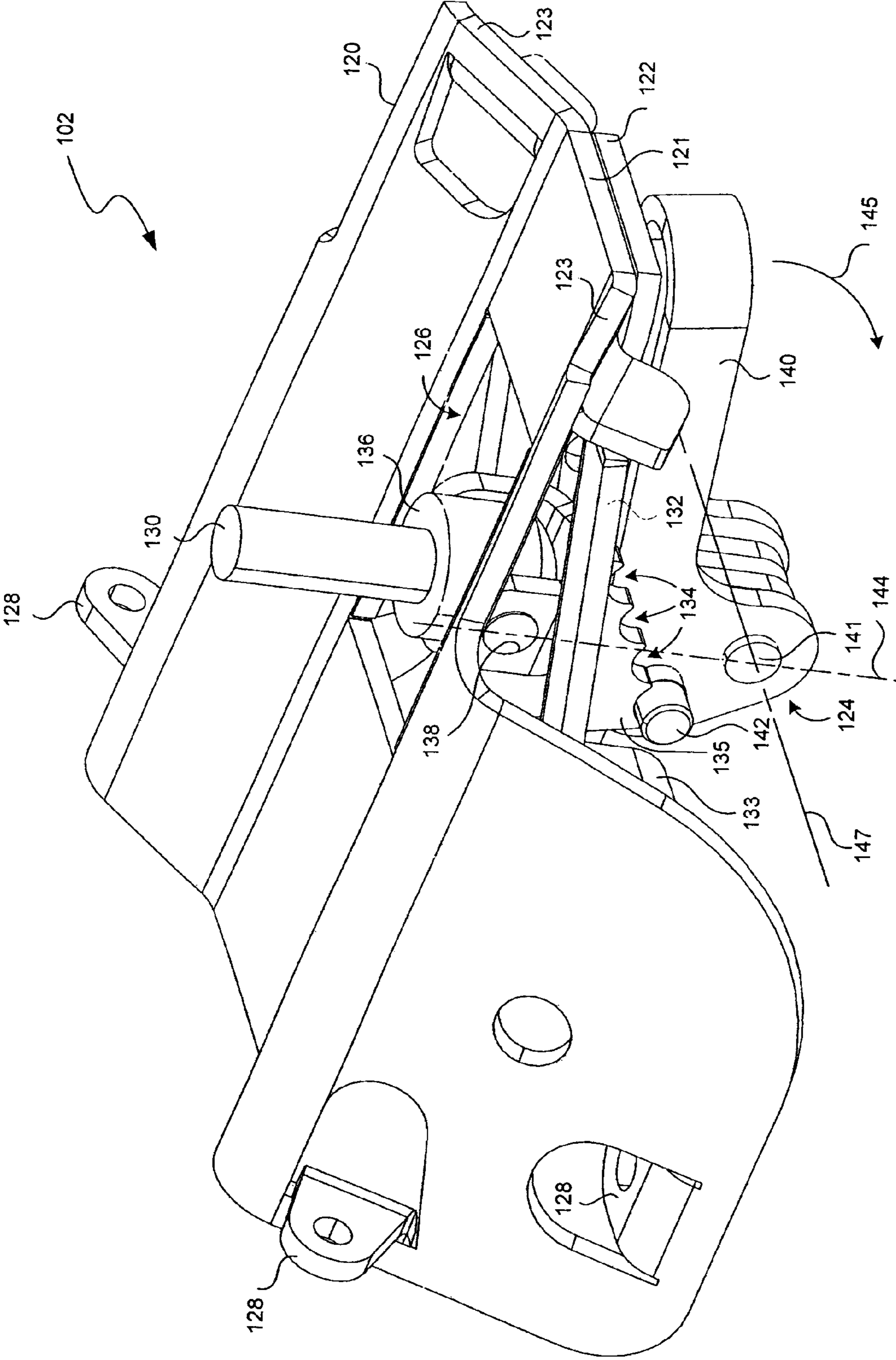


FIG. 2

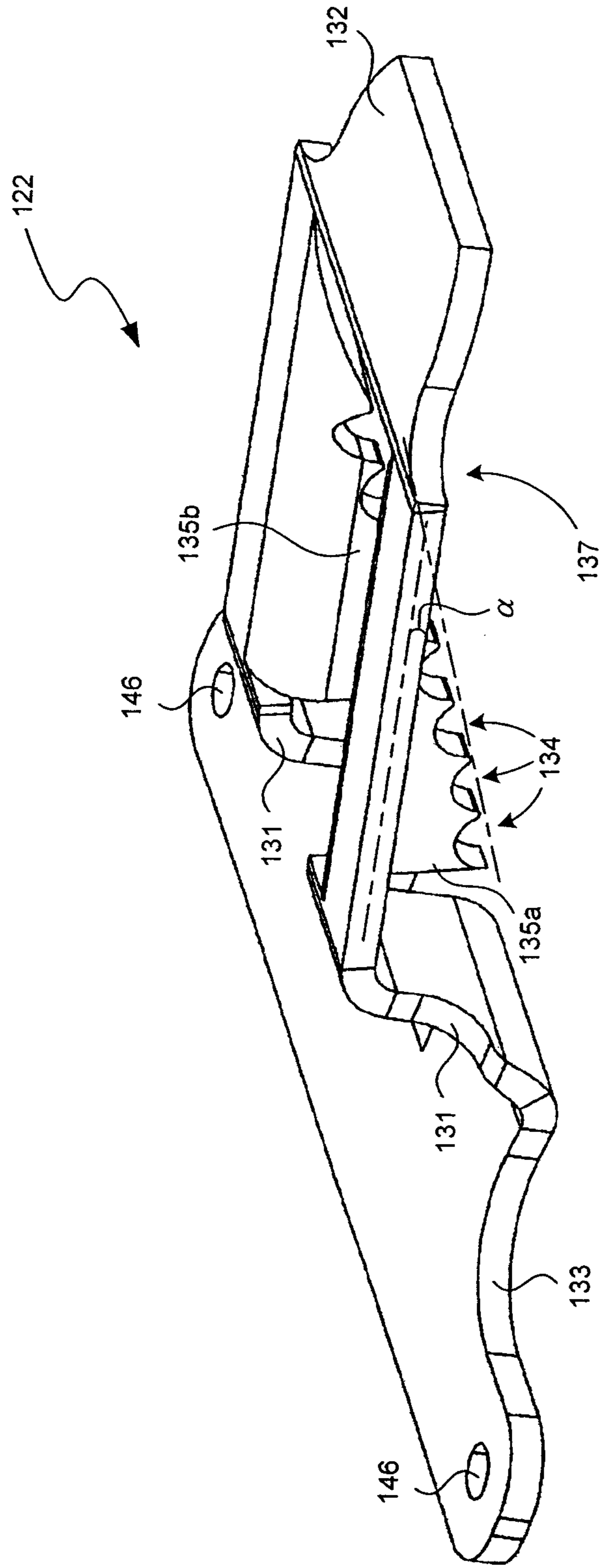


FIG. 3

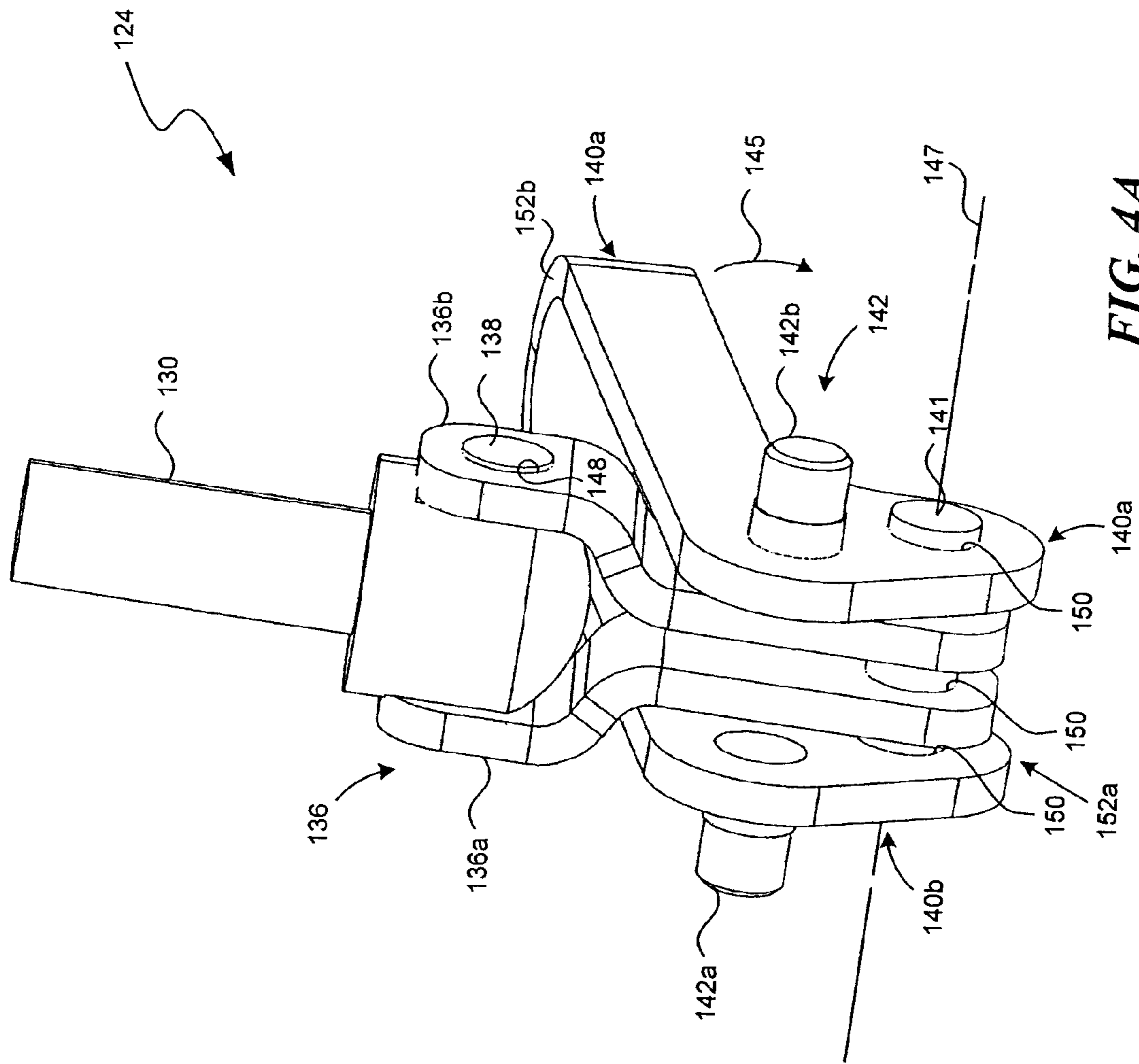


FIG. 4A

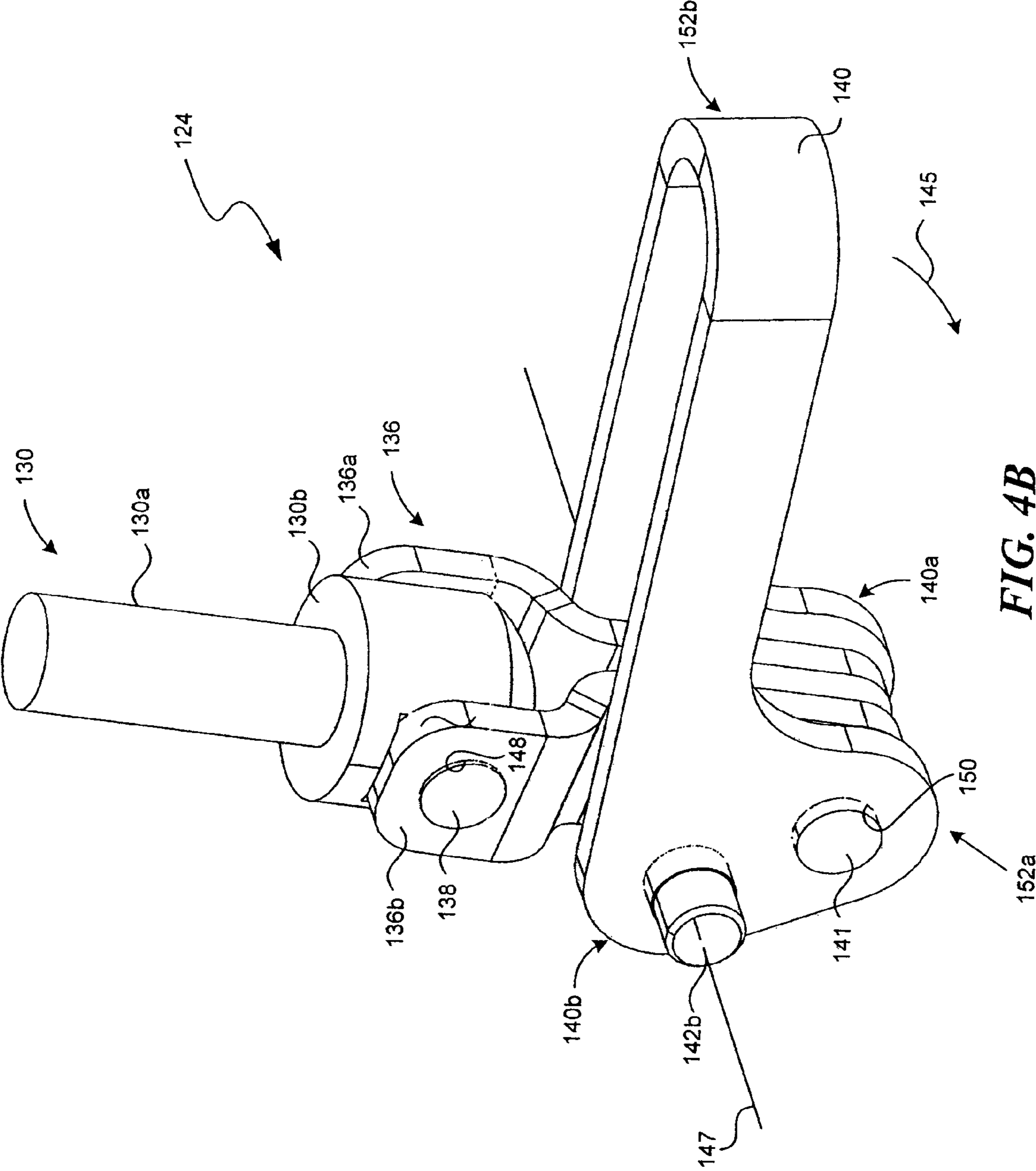


FIG. 4B

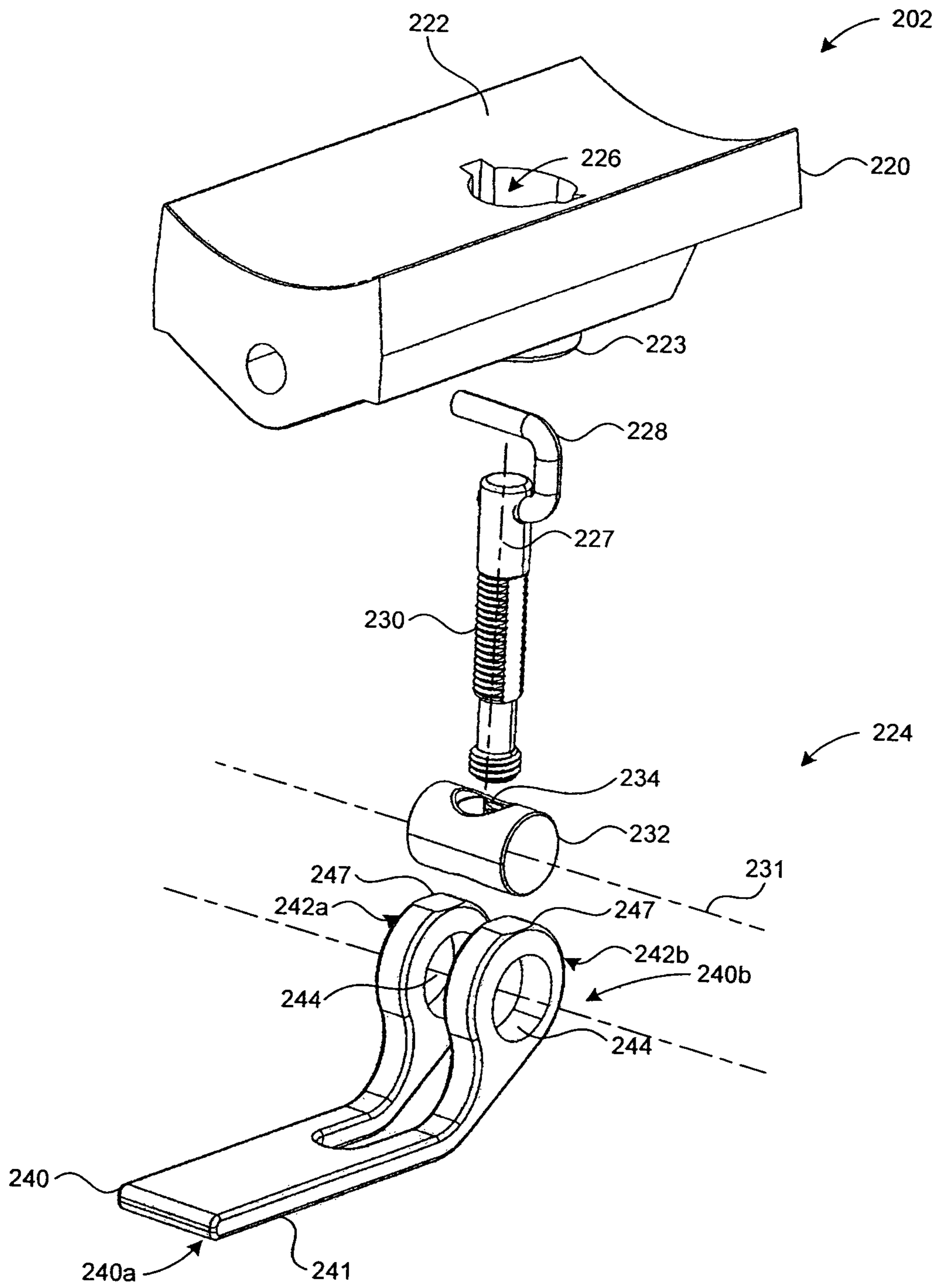


FIG. 5A

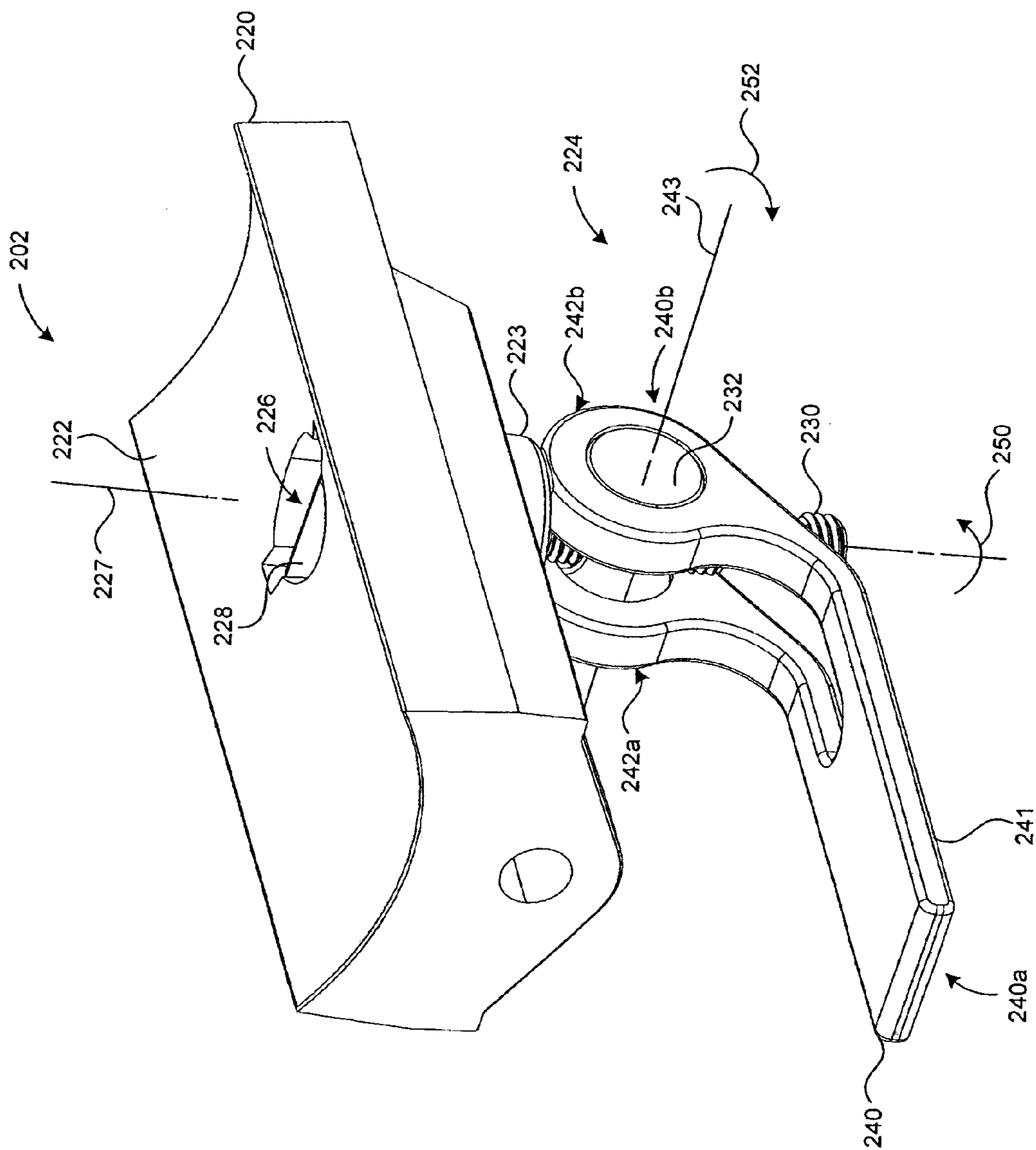


FIG. 5B

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ATTACHMENT MECHANISMS FOR COUPLING FIREARMS TO SUPPORTING STRUCTURES

CROSS-REFERENCE TO RELATED APPLICATION

The present application is a divisional of U.S. patent application Ser. No. 12/209,113, filed Sep. 11, 2008, now U.S. Pat. No. 7,845,267, which claims priority to U.S. Provisional Application Ser. No. 60/971,507, filed Sep. 11, 2007, the disclosures of which are incorporated herein by reference in their entirety.

TECHNICAL FIELD

The present disclosure is generally related to attachment mechanisms for attaching firearms to support structures, e.g., bipods.

BACKGROUND

In recent centuries, firearms have been widely used for hunting games or waging wars. To achieve precision in using firearms, monopods, bipods, tripods, gun carriages, and/or other support structures are typically attached to firearms for providing stability during firing. However, the support structures can reduce the portability of the firearms by increasing the weight and the size of the complete assemblies. Accordingly, attachment mechanisms that can enable quick attachment/detachment of the support structures to/from the firearms are needed for improved operability.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an isometric view of a firearm assembly in accordance with an embodiment of the disclosure.

FIG. 2 is an isometric view of an embodiment of an attachment mechanism suitable for use in the firearm assembly of FIG. 1 in accordance with an embodiment of the disclosure.

FIG. 3 is an isometric view of an embodiment of a mounting member in FIG. 2 in accordance with an embodiment of the disclosure.

FIGS. 4A-B are isometric views of an embodiment of a latching subassembly in FIG. 2 in accordance with an embodiment of the disclosure.

FIG. 5A is an exploded isometric view of an embodiment of an attachment mechanism suitable for use in the firearm assembly of FIG. 1 in accordance with another embodiment of the disclosure.

FIG. 5B is an isometric view of the attachment mechanism in FIG. 5A as assembled in accordance with another embodiment of the disclosure.

DETAILED DESCRIPTION

Specific details of several embodiments of the disclosure are described below with reference to embodiments of an attachment mechanism for attaching a support structure (e.g., a bipod) to a firearm. The term “firearm” generally refers to a device that can discharge a projectile with a propellant (e.g., a combustion gas, compressed air, etc.) Examples of a firearm include rifles, machine guns, muskets, air rifles/pistols, etc. Several other embodiments may have different configurations, components, or procedures than those described in this section. A person of ordinary skill in the art, therefore, will accordingly understand that the disclosure may have other

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embodiments with additional elements, or the invention may have other embodiments without several of the elements shown and described below.

FIG. 1 is an isometric view of a firearm assembly 100 in accordance with an embodiment of the disclosure. As illustrated in FIG. 1, the firearm assembly 100 can include a firearm 106, a support structure 104, and an attachment mechanism 102 connecting the support structure 104 to the firearm 106. The firearm 106 can include a barrel 108 operatively coupled to a firing mechanism 112 (e.g., a bolt-action firing mechanism), and a stock 110 at least partially supporting and/or housing the barrel 108 and the firing mechanism 112. The firearm 106 is generally illustrated in FIG. 1 as a rifle; however, in other embodiments, the firearm 106 can also be a handgun, a machine gun, and/or other types of firearm.

In the illustrated embodiment, the support structure 104 includes a bipod 114 extending from the stock 110 of the firearm 106. In certain embodiments, the bipod 114 can include two cylindrical tubes constructed from a metal, a metal alloy, a polymeric material, and/or other suitable material with sufficient strength. In other embodiments, the bipod 114 can also include springs, sleeves, pivots, and/or other features for collapsing the bipod 114 for storage and/or transport. In further embodiments, the support structure 104 can also include a monopod, a tripod, a gun carriage, and/or other support devices that can provide support to the firearm during use.

The attachment mechanism 102 can be positioned between the firearm 106 and the support structure 104. In one aspect of this embodiment, the attachment mechanism 102 can be configured to releasably attach/detach the support structure 104 to/from the firearm 106. In another aspect of this embodiment, the attachment mechanism 102 can be configured to enable a quick release of the support structure 104 from the firearm 106 for improving operability of the firearm assembly 100, as described in more detail below with reference to FIGS. 2-4B.

Even though the firearm assembly 100 is illustrated in FIG. 1 to have particular components, in certain embodiments, the firearm assembly 100 can also include shoulder straps, telescopes, external magazines, and/or other accessories for the firearm 106. In other embodiments, portions of the stock 110 and/or other components of the firearm assembly 100 can be different and/or omitted.

FIG. 2 is an isometric view of an embodiment of the attachment mechanism 102 in FIG. 1 in accordance with an embodiment of the disclosure. As shown in FIG. 2, the attachment mechanism 102 can include an interface member 120, a mounting member 122 attached to the interface member 120, and a latching subassembly 124 movably coupled to the mounting member 122. In the illustrated embodiment, the interface member 120 and the mounting member 122 are shown as stand-alone components coupleable with fasteners (e.g., bolts and nuts). However, in certain embodiments, the interface member 120 and the mounting member 122 can be formed integrally as a single component.

The interface member 120 can include a center portion 121 and two side portions 123 extending from the center portion 121. The center portion 121 and the side portions 123 can be arranged at an angle to receive and accommodate the stock 110 (FIG. 1). The center portion 121 can include an aperture 126 through which a connector 130 can extend to engage the stock 110. In one embodiment, the connector 130 can include a swivel stud. In other embodiments, the connector 130 can also include a threaded stud and/or other fasteners. The side portions 123 can also include connecting features, e.g., taps 128, for connecting to other components of the attachment

mechanism 102, the support structure 104 (FIG. 1), and/or other components of the firearm assembly 100 (FIG. 1).

The mounting member 122 can include a mounting plate 132 configured to engage the center portion 121 of the interface member 120, an anchor plate 133 configured to engage the side portions 123 of the interface member 120, and a receiving plate 135 extending from the mounting plate 132. The receiving plate 135 can include notches 134 and/or other engagement features for receiving the latching subassembly 124. Embodiments of the mounting member 122 are discussed in more detail below with reference to FIG. 3.

The latching subassembly 124 can include an attachment portion 136, a latching arm 140 movably coupled to the attachment portion 136 by a coupling pin 141, and a latching pin 142 extending outwardly from the latching arm 140 and resting in one of the notches 134 of the mounting member 122. In the illustrated embodiment, the attachment portion 136 is fixedly coupled to the connector 130 with a swivel pin 138. In other embodiments, the attachment portion 136 can be coupled to the connector 130 with a screw, a bolt, a nut, and/or other fasteners. Embodiments of the latching subassembly 124 are discussed in more detailed below with reference to FIGS. 4A-B.

Referring to FIG. 1 and FIG. 2 together, the attachment mechanism 102 can securely hold the firearm 106 and the support structure 104 together during use.

When assembled, the connector 130 is fixedly attached to the stock 110 of the firearm 106, and the attachment portion 136 is fixedly coupled to the connector 130. As a result, the latching subassembly 124 can force the stock 110 toward the attachment mechanism 102 via the connector 130 until the stock 110 securely rests on the interface member 120. Because different firearms may have different stock configurations (e.g., height, shape, etc.), a user can select one of the notches 134 that provides the required height between the latching pin 142 and the center portion 121 of the interface member 120 to securely engage the firearm 106.

During detachment, a user can pull the latching arm 140 clockwise (as indicated by an arrow 145) away from the mounting member 122. As the latching arm 140 pivots around the coupling pin 141, the latching pin 142 rotates toward an axis 144 that passes through the centers of the swivel pin 138 and the coupling pin 141. As a result, the rotation of the latching arm 140 pulls the stock 110 toward the interface member 120 because the distance between the swivel pin 138 and the coupling pin 141 increases. As all three pins (i.e., the swivel pin 138, the coupling pin 141, and the latching pin 142) are aligned along the axis 144, the attachment mechanism 102 exerts the maximum pulling force on the stock 110. As the user continues to pull the latching arm 140 clockwise, the latching pin 142 passes and moves away from the axis 144. As a result, the amount of pulling force exerted on the stock 110 is reduced because the distance between the swivel pin 138 and the coupling pin 141 decreases. As the user continues to pull the latching arm 140 clockwise, the pressure between the stock 110 and the interface member 120 can be reduced or even eliminated. After the pressure is at least reduced, the user can detach the attachment mechanism 102 from the stock 110 by removing the swivel pin 138.

FIG. 3 is an isometric view of an embodiment of the mounting member 122 in FIG. 2 in accordance with an embodiment of the disclosure. As illustrated in FIG. 3, the mounting member 122 includes the mounting plate 132, the anchor plate 133, and an intermediate portion 131 connecting the mounting plate 132 and the anchor plate 133. In the illustrated embodiment, the mounting plate 132 and the anchor plate 133 are offset from one another; however, in other embodiments,

these components can be generally planar. The anchor plate 133 can include connecting features 146 (e.g., holes) for coupling to the interface member 120 (FIG. 2) and/or other components of the attachment mechanism 102.

The mounting plate 132 can also include an opening 137 configured to at least partially align with the aperture 126 (FIG. 2) of the interface member 120. The mounting member 122 also includes a first receiving plate 135a and a second receiving plate 135b having the notches 134 and extending from the mounting plate 132 along two sides of the opening 137. As shown in FIG. 3, the tops of the notches 134 form generally a line at an angle α with the mounting plate 132. The angle α can be from about 5° to about 85°, preferably from about 15° to about 60°, and more preferably from about 25° to about 45°.

FIGS. 4A-B are isometric views of an embodiment of the latching subassembly 124 in FIG. 2 in accordance with an embodiment of the disclosure. As shown in FIGS. 4A-B, the latching subassembly 124 includes the attachment portion 136, the latching arm 140, and the coupling pin 141 pivotably coupling the attachment portion 136 and the latching arm 140 together.

The latching arm 140 includes first and second latching sections 140a-b spaced apart from one another and are eccentric relative to a latching axis 147 at a first end 152a proximate to the coupling pin 141. The latching arm 140 also includes a first latching pin 142a and a second latching pin 142b extending from the first and second latching sections 140a-b, respectively. The first and second latching sections 140a-b can be joined at a second end 152b spaced apart from the first end 152a. The attachment portion 136 can include a first attachment section 136a and a second attachment section 136b spaced apart from the first attachment section 136a at a distance suitable for accommodating the connector 130. Each of the first and second latching sections 140a-b and the first and second attachment sections 136a-b can include first apertures 150 that can be aligned along the latching axis 147 to allow the coupling pin 141 to extend through. The first and second attachment sections 136a-b can also include second apertures 148 that can be aligned to allow the swivel pin 138 to extend through. As a result, the latching arm 140 can pivot eccentrically relative to the attachment portion 136 around the latching axis 147, as indicated by the arrow 145.

FIG. 5A is an exploded isometric view of an embodiment of an attachment mechanism 202 suitable for use in the firearm assembly 100 of FIG. 1 in accordance with another embodiment of the disclosure. The attachment mechanism 202 can include an interface member 220 and a latching subassembly 224 releasably coupled to the interface member 220.

The interface member 220 can include a first surface 222 that is curved to accommodate the stock 110 (FIG. 1) and a second surface 223 opposite the first surface 222 and proximate to the latching assembly 224. The interface member 220 can also include an interface aperture 226 extending from the first surface 222 to the second surface 223. As shown in FIG. 5A, The interface aperture 226 can have a generally circular cross-section with a stepped slot that extends radially outwardly. In other embodiments, the interface aperture 226 can have other cross-section configurations to accommodate the latching subassembly 224.

The latching subassembly 224 can include a attachment portion 228 fixedly or releasably attached to a threaded shaft 230. As shown in FIG. 5A, the attachment portion 228 includes a generally cylindrical bar that can engage the attachment portion 136 (FIG. 4A) by extending through the second apertures 148 (FIG. 4A). In other embodiments, the

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attachment portion **228** can also include a pin, a screw, and/or another fastening mechanism. In the illustrated embodiment, the threaded shaft **230** extends along a shaft axis **227** and has interrupted threads. In other embodiments, the threaded shaft **230** can have non-interrupted threads and/or other configurations.

The latching subassembly **224** can also include a bushing **232** having a threaded aperture **234** to engage the threaded shaft **230**. In the illustrated embodiment, the bushing **232** has a generally cylindrical shape extending along a bushing axis **231**. The threaded aperture **234** extends through the bushing **232** generally perpendicularly relative to the bushing axis **231**. In other embodiments, the bushing **232** can having other configurations.

The latching subassembly **224** can further include a latching arm **240** releasably coupled to the bushing **232**. The latching arm **240** includes a handle **241** at a first end **240a** and first and second forks **242a-b** spaced apart from one another and extending from the handle **241** toward a second end **240b** opposite the first end **240a**. The first and second forks **242a-b** each include a cam structure **247** having an latching aperture **244** generally aligned along a latching axis **243** to receive the bushing **232**. At least one of the cam structures **247** can be eccentric relative to the latching axis **243**.

FIG. 5B is an isometric view of the attachment mechanism **202** in FIG. 5A as assembled in accordance with another embodiment of the disclosure. During assembly, the attachment portion **228** can be first engaged with the attachment portion **136** (FIG. 4A) by extending through the second apertures **148** (FIG. 4A). Then, the interface member **220** can be positioned against the stock **110** (FIG. 1) by having the threaded shaft **230** sliding through the interface aperture **226** until the attachment portion **228** rests on the stepped slot. Then, the threaded shaft **230** can extend through the bushing **232** that is received in the latching apertures **244** until the first and second forks **242a-b** are proximate to the second surface **223** of the interface member **220**. The latching arm **240** can then be rotated approximately 90° around the shaft axis **227** to engage threads of the threaded shaft **230**. Then, the handle **241** can be rotated around the latching axis. As the latching arm **240** rotates, the cam structures **247** press against the second surface **223** of the interface member **220** to pull the stock **110** toward the bushing **232** in order to secure the attachment mechanism **202** to the stock **110**.

In any of the embodiments discussed above, the attachment mechanisms can allows a user to attached/detach a support structure to/from a firearm without using tools and with improved attachment security over conventional techniques. According to conventional techniques, a threaded rod is typically used to couple to a swivel stud on a gun stock. A support structure (e.g., a bipod) is then attached to the stock and tightened by running a nut against the threaded rod. However, the motion of the bipod can cause the nut to come loose over time to undermine the attachment security. One conventional method to solve this problem is using tools to tighten the nut. However, such tools may not be available in the field. Embodiments of the attachment mechanisms solved this problem by using the latching arms with cam structures that can be rotated to exert resistance to the stock so that the bipod is less likely to come loose over time.

From the foregoing, it will be appreciated that specific embodiments of the invention have been described herein for purposes of illustration, but that various modifications may be made without deviating from the invention. Elements of one embodiment may be combined with other embodiments in

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addition to or in lieu of the elements of the other embodiments. Accordingly, the invention is not limited except as by the appended claims.

We claim:

1. An attachment mechanism for attaching a firearm to a support structure, comprising:

an interface member having an aperture and first side opposite a second side, wherein the first side is configured to contact the firearm; and

a latching subassembly proximate to the interface member, the latching assembly including—

an attachment portion configured to engage a connector extending from the firearm through the aperture; and

a latching arm coupled to the attachment portion and movable about a latching axis, the latching arm having an end portion including a cam structure configured to contact the second side of the interface member, and wherein the cam structure has a latching aperture through which the latching axis passes, and wherein the cam structure is at least partially eccentric relative to the latching axis.

2. The attachment mechanism of claim 1 wherein the latching arm pivots about the latching axis from an open position to a closed position to lockably engage the second side of the interface member and to secure the first side of the interface member against the firearm.

3. The attachment mechanism of claim 1 wherein the attachment portion includes a shaft having a shaft axis extending longitudinally along the shaft, wherein the shaft axis is generally perpendicular to the latching axis.

4. The attachment mechanism of claim 1 wherein the cam structure includes a first cam structure spaced apart from a second cam structure.

5. The attachment mechanism of claim 4 wherein each of the first and second cam structures includes a generally flat portion that contacts the second side of the interface member to at least partially secure the interface member against the firearm when the latching arm is in a closed position with reference to the interface member.

6. The attachment mechanism of claim 4 wherein the latching subassembly further comprises a bushing coupled to the attachment portion, wherein the bushing at least partially extends through each of the first and second cam structures.

7. The attachment mechanism of claim 6 wherein the bushing is rotatably coupled to the shaft and rotates on the shaft, and wherein the latching arm is pivotally coupled to the bushing and the cam structure rotates on the bushing.

8. An attachment mechanism for attaching a firearm to a bipod, comprising:

an interface member having an aperture;

an attachment portion configured to releasably engage a stud extending from the firearm through the aperture;

a shaft having a first end portion coupled to the attachment portion and a second end portion opposite the first end portion, the shaft having a longitudinal axis;

a bushing coupled to the second end portion of the shaft; and

a latching arm coupled to the bushing, wherein the latching arm moves about a latching axis between open and closed positions, wherein the latching axis is generally perpendicular to the longitudinal axis of the shaft, and wherein in the closed position the latching arm at least partially secures the interface member against the firearm wherein the latching arm includes a bushing opening that receives the bushing, and wherein the center of the bushing opening is eccentric with reference to the latching axis.

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9. An attachment mechanism for attaching a firearm to a bipod, comprising:

- an interface member having an aperture;
- an attachment portion configured to releasably engage a stud extending from the firearm through the aperture;
- a shaft having a first end portion coupled to the attachment portion and a second end portion opposite the first end portion, the shaft having a longitudinal axis;
- a bushing coupled to the second end portion of the shaft; and
- a latching arm coupled to the bushing, wherein the latching arm moves about a latching axis between open and closed positions, wherein the latching axis is generally perpendicular to the longitudinal axis of the shaft, and wherein in the closed position the latching arm at least partially secures the interface member against the firearm, wherein the latching arm includes a cam structure that rotates about the bushing, and wherein the cam structure includes a generally planar section that contacts the second surface of the interface member when the latching arm is in the closed position.

10. An attachment mechanism for attaching a firearm to a bipod, comprising:

- an interface member having an aperture;
- an attachment portion configured to releasably engage a stud extending from the firearm through the aperture;
- a shaft having a first end portion coupled to the attachment portion and a second end portion opposite the first end portion, the shaft having a longitudinal axis;
- a bushing coupled to the second end portion of the shaft; and
- a latching arm coupled to the bushing, wherein the latching arm moves about a latching axis between open and closed positions, wherein the latching axis is generally perpendicular to the longitudinal axis of the shaft, and wherein in the closed position the latching arm at least partially secures the interface member against the firearm wherein the latching arm includes a first cam portion spaced apart from a second cam portion, and wherein the bushing extends laterally between the first cam portion and the second cam portion.

11. The attachment assembly of claim 10 wherein the shaft extends at least partially through the bushing in between the first cam portion and the second cam portion.

12. An attachment mechanism for attaching a firearm to a bipod, comprising:

- an interface member having an aperture;
- an attachment portion configured to releasably engage a stud extending from the firearm through the aperture;
- a shaft having a first end portion coupled to the attachment portion and a second end portion opposite the first end portion, the shaft having a longitudinal axis;
- a bushing coupled to the second end portion of the shaft wherein the bushing includes a threaded opening that receives a threaded portion of the shaft; and
- a latching arm coupled to the bushing, wherein the latching arm moves about a latching axis between open and closed positions, wherein the latching axis is generally

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perpendicular to the longitudinal axis of the shaft, and wherein in the closed position the latching arm at least partially secures the interface member against the firearm.

13. An attachment mechanism for attaching a firearm to a bipod, comprising:

- an interface member having an aperture;
- an attachment portion configured to releasably engage a stud extending from the firearm through the aperture;
- a shaft having a first end portion coupled to the attachment portion and a second end portion opposite the first end portion, the shaft having a longitudinal axis;
- a bushing coupled to the second end portion of the shaft wherein the bushing rotates on the shaft about the longitudinal axis, and the latching arm rotates on the bushing about the latching axis; and
- a latching arm coupled to the bushing, wherein the latching arm moves about a latching axis between open and closed positions, wherein the latching axis is generally perpendicular to the longitudinal axis of the shaft, and wherein in the closed position the latching arm at least partially secures the interface member against the firearm.

14. An attachment assembly for securing a firearm to a support structure, the attachment assembly comprising:

- an interface member configured to contact the firearm, the interface member having an aperture configured to receive a connector extending from the firearm; and
- a latching subassembly including—
 - an attachment portion configured to releasably engage the connector;
 - a shaft extending from the attachment portion; and
 - a latching arm coupled to the shaft, wherein the latching arm includes a handle at a first end portion and first and second spaced apart forks at a second end portion, and wherein the shaft extends at least partially between the first and second forks wherein the latching arm pivots about a latching axis that is generally perpendicular to the longitudinal axis of the shaft.

15. The attachment assembly of claim 14, further comprising a bushing attached to the shaft, wherein the bushing extends through each of the first and second forks.

16. The attachment assembly of claim 15 wherein the latching arm rotates on the bushing about a latching axis, and wherein each of the first and second forks is eccentric relative to the latching axis.

17. The attachment assembly of claim 14 wherein each of the first and second forks includes a generally flat portion that contacts the interface member to lock the latching subassembly when the latching arm is moved to a closed position with reference to the interface member.

18. The attachment assembly of claim 14 wherein the latching subassembly further comprises a bushing coupled to the shaft and spaced apart from the attachment portion, wherein the bushing extends through at least a portion of the first fork and the second fork.

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